2023 AP Statistics Reading Commentary

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FRQs and Scoring Information

https://apcentral.collegeboard.org/courses/ap-statistics/exam

Posted here, towards the bottom, is the FRQ, scoring guidelines, and the chief readers scoring commentary about the 2023 exam. The chief reader report is a very valuable document; it gives common student errors and suggestions for teachers.

AP Statistics Teacher Community

https://apcommunity.collegeboard.org/web/apstatistics

I highly recommend this community! It's a place where you can ask questions, get wonderful classroom resources, reply to other questions, or simply read and learn as the posts come in.

Additional Resources
AP Daily
AP Classroom
Dan Shuster's chapter notes: http://www.danshuster.com/apstat/apstat_chapters.htm
ProfRobBob's youtube video playlist
Mr. Nystrom's youtube video playlist

What follows here are lesson plans and activities that help students learn and practice the content asked.

Table of Contents:

FRQ #1: Primary Focus: Exploring Data

Part A: Describe the distribution given a histogram.
https://skewthescript.org/1-3

Part B: Create a boxplot given summary statistics.
https://skewthescript.org/1-5

Part C: Compare the previous two distributions.
https://skewthescript.org/1-5

Teaching Tips:
1) https://www.lessonsthatmatter.org/statistics (Primates and Nitrogen)
2) When given a histogram, we do not know exact values for the observations. So when students report measures of center, they should give the bin in which the measure of center occurs. For other measures, they should be sure to give approximations.
3) Make sure that students use comparative words when comparing distributions (i.e., less than, greater than, similar to, etc.).

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/post/would-this-get-credit-ap-statistics-exam-2023-1

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2019	1		Describing bimodal histogram, finding outliers, making boxplot, boxplots vs. histograms
2017	4		Comparing boxplots, using boxplots to classify
2015	1	Full (Int'l)	Comparing boxplots, shape of histogram of combined distribution
2011	1	Form B	Estimating median from hist., comparing hist., mean vs. median
2006	1		Comparing distributions, variability, center
2005	1	Form B	Shape, center, spread of a distribution
2002	5	Form B	making graphs and comparing distributions

FRQ #2: Primary Focus: Collecting Data

Part A: Identify vocabulary in an experiment.
https://skewthescript.org/4-3

Part B: Randomly assign treatments to experimental units.
https://skewthescript.org/4-3
https://skewthescript.org/4-1

Part C: Purpose of random assignment.
https://skewthescript.org/4-3

Teaching tips:
1) https://www.lessonsthatmatter.org/statistics (Madagascar's Lemurs and/or Turnips and Okra)
2) Make sure to practice the vocabulary with students. Students answers are specific (i.e. "concrete with fibers or not" is unclear – is it concrete without fibers or is it another material such as gravel instead of concrete with fibers?)
3) Students need to be very specific when describing a random process (including things that they think are obvious).
4) When using the prompt as a starting point for their answer, be sure to add details that indicate they know what they are talking about and not just restating the question.

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/post/would-this-get-credit-2023-ap-statistics-exam-2

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2022	2	AP Daily Review 2023	Identify parts of an experiment, advantage of pairing, random assignment to pairs
2021	2	AP Daily Review 2022	Response bias, purpose of random sampling, cause and effect for obs study
2019	2		Components of an experiment, control group, random assigment method
2016	3	AP Daily Review 2023	Explanatory/response variables, experiment vs. obs. study, confounding
2011	2	Form B	Exp. vs. obs. study, scope of inference, purpose of random assignment
2010	1		Treatments, units, response variable; scatterplots and linearity
2006	5	Form B AP Daily	response, treatments, units, rand., replication, confounding
2006	5		Treatments, randomization, limiting variability, generealizibility
2003	4		Random assignment, control groups, generalizibility
2001	4		Blocking, purpose of randomization

FRQ #3: Primary Focus: Probability

Part A: Calculate a proportion from a discrete probability distribution. Calculate a proportion involving mutually exclusive events from a discrete probability distribution.
https://skewthescript.org/5-5

Part B: Calculate a conditional probability.
https://skewthescript.org/5-5

Part C: Calculate the expected value from a discrete probability distribution.
https://skewthescript.org/5-5

Part D: Convert the expected value to a different unit.
Practice the concept using algebra contexts.

Teaching Tips:
1) https://www.lessonsthatmatter.org/statistics (Zika Virus)
2) Students need to show their work when calculating probabilities (even for steps they think are obvious).

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/blog (at the time of this writing, this question's blog post is not yet published)

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2023	3		Discrete RV probs; cond prob from 1-way table;calc and interpret E(X); convert units
2018	3		Multiplication rule, conditional probability, binomial
2015	3		Discrete probability distributions, expected value, conditional probability
2014	4	Full (Int'l)	Multiplication rule (similar to geometric), prob dist, calc and interp expected value
2012	2	Full exam	Discrete probability distributions, expected value, normal calculations
2011	2		Conditional probability, independence, segmented bar charts
2009	2	Form B	Conditional Probability, Prob. Rules
2008	3		Expected value, probability rules and distributions
2005	2	Form B	Mean and SD of RV, combination of RV's
2005	2		expected value/median relationship, sampling variability
2004	4		Probability rules, expected value
2003	2	Form B	Conditional probability, independence
2002	2	Form B	probability, expected value, conditional prob.

2001	2		Expected Value
1999	5		Sample space, Expected values
1998	6		Normal dist, simulations, expected value
1997	3	Full exam	Conditional probability

FRQ #4: Primary Focus: Inference

Question: Hypothesis test for a mean difference.
https://skewthescript.org/8-5

Teaching Tips:
1) https://www.lessonsthatmatter.org/statistics (Yellow Lance)
2) Practice identifying the difference between a two sample inference setting and a matched pairs inference setting. Larry Green's review website can be particularly helpful.
3) Students need to know how to check conditions for an inference procedure.

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/blog (at the time of this writing, this question's blog post is not yet published)

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2000	2		Conditions for 1 sample t-interval
2005	4	Form B AP Daily Review 2022	Matched pairs t interval, sig diff?
2008	3	Form B	Sample size calculations, CI for mean
2013	1	AP Daily	Stemplots, 1 sample t interval

FRQ #5: Primary Focus:

Part A: Describe a bivariate distribution.
https://skewthescript.org/3-1

Part B: Calculate the predicted y (weight) for a specific elk with a provided chest circumference with work shown. Then, use their prediction to calculate the residual with work shown.
https://skewthescript.org/3-3

Part C: Interpret the slope of the LSRL in the context of the question.
https://skewthescript.org/3-2

Part D: Students were provided with hypotheses for a test to compare this species of elk to a different species of similar size. With a provided test statistic, students needed to calculate the p-value with df=28 and make a decision about rejecting or failing to reject the null hypothesis.
It should be noted that the test statistic should have been negative, but it didn't affect a student's ability to answer the question.
https://skewthescript.org/9-3

Teaching Tips:
1) Students needed to describe the direction, form, and strength of the provided scatter plot in context.
2) For part c, it was essential that the students use language to describe the incremental increase of x and y in context (for each additional cm of chest circumference, we predict an increase of 3.7455kg of weight...)

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/post/would-this-get-credit-ap-statistics-exam-2023-5

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2022	1		Describe scatterplot, interpret slope and r2, identify and analyze largest residual
2017	1		Describing a scatterplot, interpreting slope, residual calculations
2015	5		Describing scatterplots, classifying individuals, making a prediction
2012	1	Full exam	Describing scatterplots, influential points
2007	4	Form B Review	LSRL, residuals, influential points
2005	3	2021	residual plots, interpreting slope, r-sq, extrapolation
2004	1	Form B Form B	Interpreting scatterplot, r-sq, transforming data, res. Plot
2002	1	AP Daily	scatterplot, interpret r, r2
2000	1		Describing scatterplots
1999	1		Regression output, interpret slope+intercept, residuals
1998	4		Regression output, residuals

FRQ #6: Investigative task

The investigative task assesses multiple skill categories and content areas, focusing on the application of skills and content in new contexts or in non-routine ways.

Part A: Compute a probability given a normal distribution.
https://skewthescript.org/2-4

Part B: Compute a probability given a sampling distribution of a sample mean from a normal distribution and determine if probability is unusually low.
https://skewthescript.org/6-1
https://skewthescript.org/6-4
https://onlinestatbook.com/stat_sim/sampling_dist/

Part C: Describe a histogram (simulated sampling distribution of sample ranges) and compare 3 histograms (describe changes as n increases).
https://skewthescript.org/1-3

Part D: Use histogram to compute probability (informal P-value) and determine if combination of two observations is highly unlikely.
Rely on previous FRQs that also contain simulated sampling distributions!

Teaching Tips:
1) On normal probability calculations, make sure students show work – the most surefire to ensure this is to draw a well-labeled picture (normal curve, mean, standard deviation, boundary value, and shaded area of interest)
2) Give students plenty of practice in knowing when a question is about a *sampling distribution of a sample mean* rather than a population distribution. (It's good to give problems that give information about a normally distributed population and to then ask for a variety of probabilities, some involving individual values and others involving sample means).
3) Encourage students on any "yes/no" questions to always say "yes" or "no," even if they aren't sure of the answer! Students have to make explicit yes/no statements to get credit, and sometimes they can get a component for the correct choice even with incorrect or weak justification.
4) Practice with simulated sampling distributions early and often. Josh Tabor's "Airline Discrimination" and Doug Tyson's "Smelling Parkinson's" are great first-day activities that get students accustomed with simulated sampling distributions from day 1!

StatsMedic Blog: Would this get credit?
https://www.statsmedic.com/blog

Previous FRQ's that address similar content for student practice.

Year	#	Notes	Content
2019	6	AP Daily Review 2021	Scope of inference, mean/median, developing sampling dist, bootstrapping a median, simulated sampling distribution

2015	6	Full (Int'l)	Make and compare stemplots, concl from p-value, sim to test ratio of SDs, simulated sampling distribution, making conclusion with simulated P-value
2009	6	AP Daily Review 2021	Hypotheses, measuring skewness, sampling dist., simulated sampling distribution, making conclusion with simulated P-value
2005	6	Form B	1 sample t test, normal, prob rules, simulation, simulated sampling distribution, making conclusion with simulated P-value
2004	6	Form B	2 sample z test, re-capture technique, random sampling, Computing probabilities from normal pop., sampling. dist. of sample mean